DOCUMENT RESUME

ED 466 602 IR 021 337

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TITLE	Web Information Resources for Students with Disabilities: How Accessible are They?
PUB DATE	2001-00-00
NOTE	7p.; In WebNet 2001: World Conference on the WWW and Internet Proceedings (Orlando, FL, October 23-27, 2001); see IR 021 310.
PUB TYPE	Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE	EDRS Price MF01/PC01 Plus Postage.
DESCRIPTORS	*Access to Information; *Accessibility (for Disabled); Comparative Analysis; *Computer Uses in Education; *Disabilities; Elementary Secondary Education; Foreign Countries; Postsecondary Education; User Needs (Information); Users (Information); *World Wide Web
IDENTIFIERS	Australia; Canada; United Kingdom; United States; Web Browsers; *Web Site Design; *Web Sites

ABSTRACT

This study investigated whether World Wide Web information resources for students with disabilities are accessible and whether there is an accessibility difference between Web sites from the United Kingdom, United States, Australia, and Canada as rated by the Bobby automatic accessibility tool. Thirty academic Web sites from each country were tested. The analysis revealed that in general there was a higher percentage of accessible Web sites in the study than most of the results from other studies, but 48% of the sites were still inaccessible. The United Kingdom and U.S. Web sites were superior to the Canadian and Australian sites for major accessibility issues. The difference was less clear in minor accessibility issues. There was no significant difference in browser compatibility error across all originating countries. (Contains 14 references.) (Author/MES)

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Web Information Resources for Students with Disabilities: How Accessible are They?

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Abstract: This study is aimed at investigating whether web information resources for students with disabilities are accessible and whether there is accessibility difference between web sites from U.K., U.S., Australia and Canada as rated by Bobby automatic accessibility tool (http://www.cast.org/bobby). Thirty academic web sites from each country were tested. The analysis revealed that in general there was higher percentage of accessible web sites in this study than most of the results from other studies, but 48% of the sites were still inaccessible. The U.K. and U.S. web sites were more superior to the Canadian and Australian sites for major accessibility issues. The difference was less clear in minor accessibility issues. There was no significant difference in browser compatibility error across all originating countries.

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Introduction

Internet and People with Disabilities

With more and more information and services available for public over the Internet, it is imperative that no element of society be left out. The World Health Organization estimates that seven to ten percents of the world's population are disabled, either physically or cognitively (WHO, 1999). People with disabilities are supposed to be offered unprecedented opportunities to access information and services over the Internet, because people with disabilities for the most part use the Internet in the same way everyone else does. They look for items of interest, use newsgroups, send email, purchase items, and research topics, to name a few. The difference between people with and without disabilities is that many people with disabilities face certain difficulties in using the technology needed to access the Internet. The difficulties are varied and diverse because of the wide variety of disabilities and because the issue of accessibility has not been considered as a major issue in web site design.

Fortunately, in recent years the number of sites devoted to disability issues keeps increasing. There are now sites and Internet services (such as mailing lists or chat rooms) that are devoted to specific disability issues. Ironically, in some cases these sites are inaccessible to people with disabilities (Burks et al., 2000).

Much of the base work on web accessibility (simply called the Web Content Accessibility Guidelines or WCAG) has been initiated by the international organization W3C. For the past several years W3C has researched, codified, and encouraged people to make their Web sites accessible. W3C also produced guidelines to help create accessible Web sites and continued to conduct research into how to make Web sites accessible. More and more countries have also taken the initiative to make Web sites more accessible. In the U.S. there are several federal laws related to accessibility of information technology, e.g. the Americans with Disabilities Act (http://www.usdoj.gov/crt/ada/adahom1.htm), Section 508 of the Rehabilitation Act Amendments of 1998 (http://www.ed.gov/offices/OSERS/RSA/RehabAct.html) and Section 255 of the Telecommunications Act of 1996 (http://www.fcc.gov/cib/dro/section255.html). Some sections of the Disability Discrimination Act in the United Kingdom came into force in October 1999, requiring service providers to make adjustments for people with disabilities. The Act itself has regulated the accessibility of government Web sites since 1995 (disability.gov.uk, 2000). The Australian's Disabilities Discrimination Act of 1992 has helped pave the way to making information technology more

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accessible to people with disabilities. The Australian Department of Communications, Information Technology and the Art (2000) has also been quite forward in publishing material dealing with accessibility of electronic commerce and of information technology. The Government of Canada Internet Guide (1998) has an extensive chapter on building Web sites that are accessible to people with disabilities.

Internet for Students with Disabilities

Students with disabilities represent quite a significant portion of students in the world. In the calendar year of 1997-1998, 12.8% elementary and secondary students in the U.S. were disabled (National Center for Education Statistics, 1999). In the 1995-1996 survey by National Postsecondary Student Aid Study (NPSAS) of 21,000 representative sample of U.S. undergraduates, six percent stated to have disabilities (Hurst & Smerdon, 2000). In a Postsecondary Education Quick Information System (PEQIS) survey of 1998, a representative sample of two-year and four-year postsecondary institutions was asked about the enrollment of students with disabilities in 1996–1997 or 1997–1998. Seventy two percent of 5,040 U.S. institutions enrolled students with disabilities in those academic years (Hurst & Smerdon, 2000). Recent statistics show that, depending on the definition used, up to fifteen percent of Canadian students arrive at school with some kind of severe physical or mental disability (Canadian's Teacher Federation, 2000).

Realizing the importance of accommodating the students with disabilities, some countries developed some regulations related to facilitating students with disabilities. In the U.S., the Individuals with Disabilities Education Act (IDEA) were signed into law on June 4, 1997 (OSERS, 1997). The Chancellor's Office of California Community Colleges (1999) issued Distance Education Access Guidelines for Students with Disabilities to ensure that distance education in the community college system in California is accessible to people with disabilities. Texas Education Agency (2000) regulated the designs of electronic textbooks to accommodate students who are blind or vision impaired.

In the U.K., the Disability Rights Commission (2001) recently welcomed the announcement of the Special Education Needs (SEN) and Disability Rights in Education Bill and an additional £220 million to improve access for disabled students and children. The Disability Discrimination Act also contains a section on accommodating students with disabilities (disability.gov.uk, 2000):

> *The Act ensures recognition of the needs of disabled people wishing to study and the provision of better information for parents, pupils and students.*
>
> - *Schools will have to explain their arrangements for the admission of disabled pupils, how they will help these pupils gain access and what they will do to ensure they are treated fairly.*
> - *Further and higher education institutions funded by the Further and Higher Education Funding Councils will have to publish disability statements containing information about facilities for disabled people.*
> - *Local Education Authorities will have to provide information on their further education facilities for disabled people.*

Although it seems that the legal and mandates of web accessibility of information resources for students with disabilities have been well organized and set up in those countries, the practice is somewhat different. In Canada, a study of 27 colleges and universities web homepages revealed that 25 of them failed the "audit" for Web accessibility as reported by Bobby (www.cast.org/bobby), an automatic web accessibility evaluation tool (Dadson & Landon, 2000).

This study aims to extend Dadson and Landon's study (2000) in two ways

1. By analyzing more web sites (120 sites) and focusing only on web sites that contain resources and supposedly designed for students with disabilities.
2. By performing group comparisons of university web sites from four different English-speaking countries across different continents (Canada, U.S., Australia and U.K.).

This study aims to answer two research questions:

1. How accessible are academic information resources for students with disabilities are in four English-speaking countries across different continents (Canada, U.S., Australia and U.K.) as rated by Bobby?
2. Are there significant differences in accessibility measures of those four groups of web sites?

The choice of English speaking countries only in the present study was because there is a need to visually observe the content of the web sites. There are limitations of using an automatic accessibility tool in evaluating a site. Specifically, Bobby works at the code level when evaluating a web site. However, even

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if the web site received Bobby's approval at the code level, if the content is outdated or written in a language not understood by some users, the site will be deemed useless. For example, in the U.S. there is a mandate that all public sites should be comprehensible by people with Grade Eight formal education. If the sites were written in more complex language, some users might not understand them. Therefore, there is a need to visually observe the contents of those sites.

Methodology

Data Collection Method

Thirty academic/education web sites from each of those four countries containing online information resources/services for students with disabilities were used in the study. The web sites were collected using keyword search of "services for students with disabilities" from http://www.google.com search engine. The web site's domain name extension (.edu, .ca, .ac.uk, and .edu.au) was used as a filter. Since Canadian university sites are not differentiable from other Canadian sites (e.g. commercial, governmental or organizational), visual observations were involved in ensuring that the web sites were academic sites.

Measures

There are eight measures from Bobby's report used in the present study:

1. *Priority 1,2 and 3 Errors* (their variable names are P1E, P2E and P3E respectively) are problems that affect the page's usability by people with disabilities at various levels, in accordance with Priority 1,2 and 3 of the WCAG.
2. *Priority 1, 2 and 3 User Checks* (P1UC, P2UC and P3UC) identify possible Priority 1,2 and 3 errors that cannot be fully automatically checked, indicating that the user will need to check them manually.

Note: if a web site passed the Priority 1 and Priority 1 User Check, it meets the Conformance Level A of the WCAG. Priority 2 corresponds to Level AA, and Priority 3 corresponds to Level AAA.

3. *The Browser Compatibility Errors* (Browser) are HTML codes that are not valid for some browsers. These errors do not necessarily cause accessibility problems, but the pages may not be rendered as expected which may impact their accessibility.
4. *Bobby's Approved* status (Approval) is symbolized with a picture of "Bobby-hat". Hats with wheelchairs indicate Priority 1 accessibility errors. Hats with a question mark identify Priority 1 User Check errors. Bobby's Approved status is equivalent to the Conformance Level A of the WCAG.

Analysis

To investigate how accessible the web sites from a particular country were, the means and standard deviations of all Bobby's measures were calculated. To investigate the accessibility differences between the sites from those four countries, their means were compared using Analysis of Variance (ANOVA) and the Least Significant Difference (LSD) post-hoc analysis when the ANOVA showed significant differences.

Results and Discussions

The descriptive statistics of the four tested categories are listed in Table 1. Visual observation showed that tested web sites from the U.K. have the highest Bobby's approval (67%) which is close to the percentage of approved sites from the U.S. (63%), followed by Australian sites and Canadian ones as the lowest one. Because Bobby's approval rating is closely related to Priority 1 ratings, the sites from the U.K.

and the U.S. were tie as the lowest at 0.37, while Canadian and Australian sites were close at 0.7 and 0.73. The separation between sites from U.K./U.S. and Canada/Australia were less clear in other ratings.

The results from Table 1 shows that across all tested countries, web sites containing information for students with disabilities are quite highly accessible (52% of the 120 web sites). Studies on web site accessibility found much lower percentage: ranging from 7.4% of 27 Canadian university sites (Dadson & Landon, 2000) to 28% of 120 U.S. health/aging web sites (Zaphiris & Kurniawan, 2001). It is not surprising that the sites tested in the study have higher accessibility since these sites were supposedly used by students with disabilities. However, it should be noted that almost half of the sites are not accessible for their prospective users, which should be viewed as a serious problem by the web designers of information resources for people with disabilities. In general, all of the accessibility measures in the present study are slightly lower than the findings from other studies (e.g. Zaphiris & Kurniawan, 2001) where the sites were not designed with people with disabilities in mind. Therefore, to answer the first research question, the evaluated web sites from these four countries are quite highly accessible compared to what other studies found.

Country		Approval	P1E	P1UC	P2E	P2UC	P3E	P3UC	Browser
U.S.	Mean	0.63	0.37	6.57	1.87	12.77	1.43	12.10	3.67
	S.D.	0.49	0.49	1.41	0.94	1.30	0.57	1.60	2.50
Canada	Mean	0.40	0.70	7.03	2.00	13.07	1.63	12.53	4.60
	S.D.	0.50	0.65	1.88	1.05	2.05	0.49	1.61	3.56
U.K.	Mean	0.67	0.37	7.47	2.40	14.17	1.73	13.00	6.03
	S.D.	0.48	0.56	1.74	1.13	1.76	0.45	1.46	5.29
Australia	Mean	0.37	0.73	7.67	2.63	14.47	1.87	13.27	5.47
	S.D.	0.49	0.64	1.47	1.30	1.74	0.51	1.68	3.86
Total	Mean	0.52	0.54	7.18	2.23	13.62	1.67	12.73	4.94
	S.D.	0.50	0.61	1.67	1.14	1.86	0.52	1.63	3.98

Table 1: Descriptive statistics of Bobby's ratings by originating countries

Across all countries, the ANOVA showed significant differences ($p<0.05$) for all of Bobby's measures except for the browser compatibility errors, and a marginal significance for the Priority 1 User Checks ($p=0.050$). The finding that there is no significant difference in browser compatibility errors suggested that there is less variation from the designers of these countries in facilitating browser compatibility. The LSD post-hoc test revealed that the mean differences were significant ($p<0.05$) for the combinations listed in Table 2.

Comparison	Significant difference
U.S. vs. Canada	Priority 1 errors
U.S. vs. U.K.	all User Checks, Priority 3 errors
U.S. vs. Australia	Bobby's approval, all Priority errors
Canada vs. U.K.	Bobby's approval, Priority 1 errors, Priority 2 User Check
Canada vs. Australia	Priority 2 errors and User Check
U.K. vs. Australia	Bobby's approval, Priority 1 errors

Table 2: Results of LSD post-hoc test

The post-hoc test' results confirm the visual observation of Bobby's approval: U.K and U.S are at the top of the chart and Canada and Australia are at the low end of the chart in terms of major accessibility issues (i.e. Bobby's Approval and Priority 1 errors). However, in some cases the difference is gradual. For example, while the difference between U.K. (which has the highest rating) and U.S. (the second) is not significant in Bobby's Approval, the difference between U.K. and Canada (the third) is significant, but the difference between U.S. and Canada is not significant.

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Interestingly, in terms of Priority 1 errors, the separation between U.K./U.S. and Canada/Australia is clearer. There is significant difference between U.K. and Canada/Australia as well as between U.S. and Canada/Australia. As mentioned above, the difference between countries in terms of other priorities or user checks are less clear. The results simply implied that the designers of the more top-tier site group focused their attention in facilitating the major accessibility issues and paid less attention in the minor issues.

Based on the descriptions in the previous two paragraphs, to answer the second research question, the web sites from U.S. and U.K. are very similar in major accessibility ratings and are more highly rated than the sites from Canada and Australia (which are also very similar in major ratings). In minor accessibility issues, the separation is less clear between those four countries.

Visual observation on the information content of the tested web sites revealed that most sites were updated and contain information of some value to students with disabilities. Another interesting observation, the top three sites from each country are usually from the highly ranked universities. These top three sites by first choosing the sites with Bobby's approved status (which also means no Priority 1 error) and the least Priority 2 error. In the case of tie, the sites with the least Priority 3 win. The winners from the U.S, for example, are web sites from Northwestern University, Harvard University and Georgia Institute of Technology. Although it may be implied that highly ranked schools put more efforts in accommodating students with disabilities, further studies to correlate university ranking with the accessibility ratings need to be done.

Conclusions

This study is aimed at investigating whether web information resources for students with disabilities are accessible and whether there is accessibility difference between web sites from U.K., U.S., Australia and Canada using an automatic accessibility tool. The analysis revealed that in general higher percentage of the web sites tested was more accessible than what other studies showed, but almost half of them were still inaccessible. The U.K. and U.S. web sites were more superior to the Canadian and Australian sites for major accessibility issues but the difference between the sites from those four countries was less clear in minor accessibility issues.

The finding of this study brought some suggestions for practitioners. The Internet is growing at a rate higher than anyone could have imagined. Everyone, including students with disabilities, uses the Internet for almost every aspect of life. If students with disabilities are not accommodated in the burgeoning world technology, they may be left behind. Accessibility does not always mean that all pages are limited to plain text. More sophisticated pages can and should also be made accessible by involving provision of alternatives to an otherwise inaccessible feature, rather than any requirement to avoid innovative design.

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